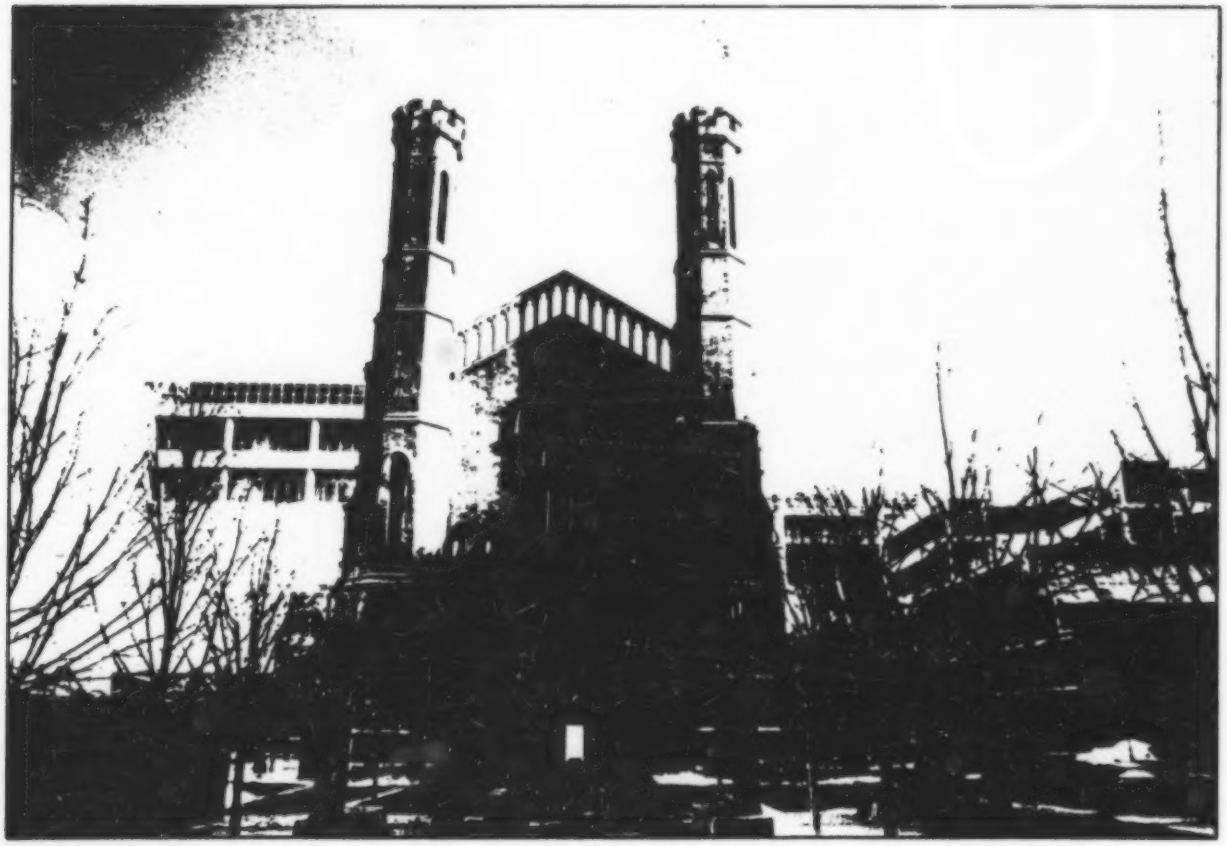
Heritage Buildings and Energy Conservation



The restored 140-year-old Church of the Holy Trinity sits in the shadow of the Eaton Centre in downtown Toronto. Renovations, including conservation measures, have resulted in increased use of the building seven days a week.

Ontario
Ministry of Energy
Honourable Vincent G. Kerrio
Minister

Although 1974 may be remembered as the year energy conservation first began to seize the country's imagination, it was also the year heritage conservation began to capture the province's attention. In the 12 years since the Ontario Heritage Act was passed, more than 2,000 residential, religious, commercial, municipal and other buildings have been officially recognized for their historic or architectural value by the province's municipalities. And, as energy conservation measures seeped into the public's consciousness during the last decade, so too have they gradually worked their way into Ontario's heritage buildings – often with disastrous results, according to Toronto restoration architect, Spencer Higgins.

"With heritage buildings, you can't just barge in and blindly apply conservation measures. You have to take the individual character of each building into consideration," says Higgins. And that, adds Herb Stovel, director of education and training for the Heritage Canada Foundation, means caution: "These buildings have existed – in some cases very well – for a century or more without any particular attention to energy conservation. Poorly considered retrofit activities can ruin their character and their historic value."

Still, effective energy conservation measures can be applied to older buildings, says Higgins, as long as the approach taken is "repair rather than replace" wherever possible. Admittedly, the financial savings may be less dramatic than with new construction. But then, the historical saving, the preservation of a very real part of what makes us Canadians – our architectural heritage – is worth the compromise.

The following cases illustrate effective yet architecturally sensitive approaches to the energy management of heritage buildings.

■ CITY HALL, KINGSTON, ONTARIO

Low-cost measures led to big savings in historic Kingston City Hall.

Ed Preston and the 143-year old Kingston City Hall are proof that a little money, some common sense and a lot of dedication can create small energy-conservation miracles with municipal heritage buildings. Applying what he calls "the basics of energy conservation" to city hall, Preston, who is building maintenance foreman for the Kingston Parks and Recreation Department, saved the city approximately $35,000 in energy bills between 1976 and 1980 (at a cost of about $3,000). As well, a variety of energy-efficient windows were installed in 1984, saving the city an additional $3,000 in energy costs a year later. And, says Preston, it was all done without detracting from the historic value of the building, a massive limestone structure of the British renaissance Tuscan revival style. Preston's "basics" of energy conservation centered on when and how city hall was being used and included the following measures:

Fall 1976: Nine time-clocks were installed on the building's air-handling units to shut them down between 11:30 p.m. and 7:00 a.m., when the building was not being used. Preston also had security turn off the building's breakers that control the lighting at 4:30 p.m. and instructed the cleaning staff to turn off the lights when they finished cleaning an area. This meant that all lights in the 90,000 square foot building, aside from the hallways, were out by 12:30 a.m.

Spring 1977: Preston replaced 180 of the building's 150-watt, incandescent light bulbs in overly lit hallways and committee rooms with 75-watt bulbs.

Spring 1978: Using a light meter, Preston walked the halls of city hall, taking light readings of everything from offices and storage rooms to washrooms. Then, armed with recommended lighting standards for the various areas, he removed 140 four-foot fluorescent tubes. While a few of the city-hall staff asked Preston "when the candles would be passed out," there were, he says, few complaints.

Spring 1979: All standard 40-watt, fluorescent tubes were exchanged for 35-watt, energy-efficient tubes. Light switches were labelled "turn off and save," and energy conservation guidelines were developed and distributed to the building's staff.

Together, these "low-cost and no-cost measures," says Preston, reduced kilowatt-hour consumption from 1,636,800 in 1976 to 1,039,800 in 1980.

Fall 1984: With the assistance of a grant from the provincial Ministry of Energy Municipal Oil Conversion and Energy Conservation Program, Preston added a mixture of standard interior aluminum storm windows and plastic storm windows to the city hall's existing single-pane windows. Altogether, the windows cost about $18,000, and Preston estimates a payback period of 3.3 years. He adds that the plastic windows, applied over windows that don't open, are about one-quarter the price of regular interior storms and are "a blessing for heritage buildings because you can't see them and they have a life expectancy of 10 years."

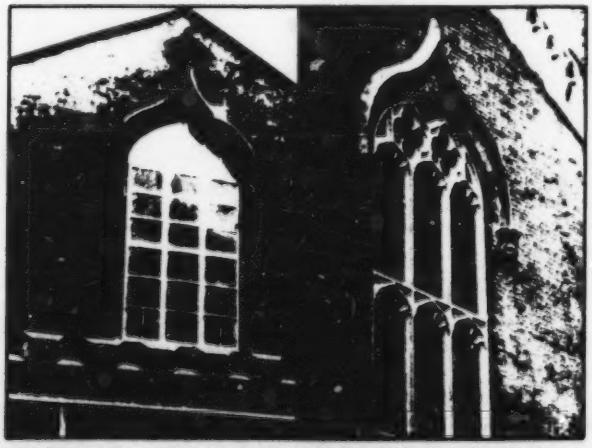
The addition of the storm windows, along with weatherstripping to all windows and doors, cut gas consumption by about 6,100 cubic metres in 1985. Although Preston said he could have saved more money with tinted storm windows, "they didn't have tinted glass back in 1843, so we didn't want it in 1984."

■ CHURCH OF THE HOLY TRINITY, TORONTO

Trinity Square circa. 1875, J.R. Robertson Collection. Photo reproduced with permission from the Anglican Diocese of Toronto Archives.

Ann Wainwright can't point to even a small miracle in energy cost reductions following the two-year, $2.2 million restoration and renovation of the Church of the Holy Trinity. Its use patterns before and after the renovation are simply not comparable. But, since the completion of renovations to the 140-year old church in October 1985, the administrator for the church's board of management can – and does – talk proudly of Holy Trinity's new-found ability to serve as "an oasis of humane values in the commercial heart of Toronto."

The brick, Gothic revival church, which sits in the shadow of the Eaton Centre in downtown Toronto, has always been what Wainwright calls "a cold, drafty, uncomfortable building". For years, because of its chilly interior, it was used only for Sunday service and the occasional meeting or concert. Now, with the development of Trinity Square Park and a restored building, the church is welcoming an increasing number of people, seven days a week. Besides an expanded CBC fall concert series and a number of other concerts, the church has become a popular venue for public forums and meetings of all kinds. The renovations of the church were supervised by restoration architect, Spencer Higgins of Toronto.



Left. Exterior storms hid the stained-glass windows and led to decay of the framing. Right. During restoration the storms were removed and the windows were caulked and re-leaded where necessary.

For his part, Higgins says his energy-conservation measures were necessarily modest, "since we wanted to preserve the original character of the church." First, Higgins removed the exterior storms, which had been mounted over the church's original stained-glass windows. "The storms were plain ugly, they leaked and were contributing to the decay of the wooden window framing and stained glass," he says. And he decided against new double glazing because he didn't feel he could justify "a $50,000 expense for a saving of not much more than $500 a year." Money was better spent, he says, "on basic air-infiltration control measures on the original windows."

Those measures included caulking, sealing and, where necessary, re-leading the stained-glass windows. They also included the addition of a new vestibule on the south side of the building to minimize drafts, and extensive weatherstripping to the doors of the existing vestibule. As well, at a cost of $3,600 Higgins sealed all cracks and joints in the church ceiling to prevent hot air from leaking into the attic. He also restored the adjustable crawl-space vents located around the perimeter of the building. When open, the vents allow summer humidity to escape; closed, they keep winter's chill outside.

Aside from air-infiltration measures on the 14,500-square-foot church, Higgins updated the electrical heating system, incorporating a set-back, zone-control system in place of the church's inefficient, single-thermostat control system: "The zone system, with its strategically located thermostats and a computerized master control for the whole building, reads the exterior temperature and monitors the interior average temperature to determine when to turn the heat on and off," says Higgins. "It should," he adds, "mean long-term energy savings with good comfort levels when required."

It should also help bring more people into the church which says Wainwright, is one of the primary aims.

■ MONTGOMERY'S INN, ETOBICOKE, ONTARIO

In Ontario, many heritage buildings are used to house museums. But, according to Christopher Borgal, an architect in Blyth, Ontario, while most museum managers "have some basic understanding of the need of their artifacts for a controlled environment, many are just beginning to appreciate the consequences of the heating system for their building." Unfortunately, adds Borgal, "often the most important artifact in the museum is the building itself."

Borgal, who is working on the repair and renovation of a number of museums in Ontario and Quebec, says Montgomery's Inn is typical of many small Ontario museums. Located in Etobicoke, Ontario, and built in about 1830, the 6,600 square foot inn is a fine example of Loyalist or late Georgian architecture. Opened in 1975 by the City of Etobicoke, the museum depicts the way of life of its original owner, Thomas Montgomery, a nineteenth-century innkeeper, farmer and businessman. As a museum, it works well. As a building, one of its biggest problems, says Borgal, is its heating system – radiant electric heating cables buried in the ceiling. The ceiling cables are, he says, "inappropriate for the building."

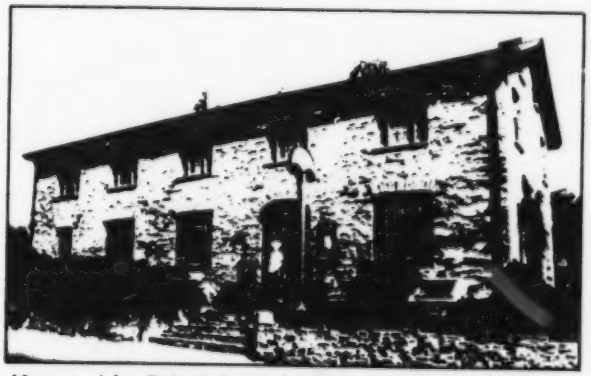
More than inappropriate, the system's rapid heating and cooling, localized in the ceiling, was a major contributing factor in the collapse of the ceiling in the bar a few years ago. And although the ceiling has since been restored, large cracks are again evident. "The ceiling,"

says Borgal, "is simply too big for the capabilities of the heating system." And, since there is no insulation in the building's stone walls, the walls are always cool, which means the system is overheating, adding even more expansion and contraction stresses to the ceiling. Added to this, the walls, says Borgal, "are frequently at the dew (condensation) point", and constitute a moisture hazard to the artifacts on or near them.

Borgal's design study recommends removable interior storm windows for the single-pane windows. This, he says, will reduce the heating load from 15 watts per square foot to 10. The storms, which are made of plexiglass, would also reduce harmful ultra-violet radiation, minimizing the fading of museum artifacts. At present, ultra-violet radiation is reduced by a filter on the glass.

Borgal also recommends the use of portable water- or oil-filled electric heaters, which would in effect reduce the ceiling system to a backup role. The heaters, he says, will provide even heat, minimizing the fluctuations in temperature and humidity. While an air-supply system would be even more efficient, Borgal says it would mean installing permanent ducts, "which would irreversibly compromise the integrity of the building." The beauty of the portable heaters, says Borgal, is that although they are visible, they are also – like the plexiglass storm windows – easily removed.

Borgal says these and other recommendations (including portable dehumidifiers for the summer) will cost about $25,000, with a 10-year payback period. But, he stresses, "it's the museum – the structure itself – that must take precedence when considering environmental controls. If you happen to get energy savings, too, well that's even better."



Montgomery's Inn, Etobicoke, built in about 1830, now houses a museum. The architect's recommendations for restoring the building stress measures that do not irreversibly alter the building itself. Portable heaters and plexiglass storm windows are suggested.

■ HOCHELAGA INN, KINGSTON, ONTARIO

Not all heritage buildings can – or should – be turned into museums. Increasingly, older properties are being restored as commercial ventures ranging from office buildings to pubs, and through the efforts of one company – Someplace(s) Different of Picton, Ontario, – luxury inns. Opened in 1985, the Hochelaga Inn in Kingston, originally a house, is one of four such Ontario inns owned by Someplace(s) Different.

Bruce Downey, of Inglis & Downey Architects in Kingston, was responsible for the latest reincarnation of the 102-year old Hochelaga (it was once owned by the Bank of Montreal and, most recently, served as an apartment building). He says that whether a heritage property is a municipal building, a church or a commercial building, "many of the same common-sense, energy-efficiency measures will apply – if you are sensitive to the historic values of the building." In the case of the Hochelaga Inn, Downey says the owners actually encouraged him to preserve the architecturally significant features of the three-storey, red-brick Victorian building.

To capture the sense of the original interior spaces, Downey went so far as to obtain original architectural drawings along with basic sketches of the building from the National Archives in Ottawa. His energy-conservation measures, on the other hand, were less dramatic, one such measure was the addition of an interior pane of glass to each window sash.

The Hochelaga Inn in Kingston is being restored to maintain the look and function of a heritage building, while providing the comfort of a modern inn.

"Others, says Downey, "might have sealed the windows and air-conditioned the building. We just didn't think it was warranted here. Part of the character of a heritage building is not only its look but its function. By adding interior panes, we were able to maintain the windows as operating windows." (see chart on page 4)

The inn's front doors were refinished on site to minimize the risk of damaging their ground-glass panels, which are etched with, among other things, the Bank of Montreal insignia. As well, the roof was re-shingled and insulated, the attic was gutted and ventilation channels were fitted into each rafter space to allow for proper ventilation. As for the mechanical system, two high-efficiency, gas-fired boilers were installed. And for economical as well as heritage reasons, the original radiators, some with ornate cast-iron covers, were kept. Thermostats controlling the radiators were installed in each of the inn's 21 rooms.

Hochelaga has been fitted with a few other concessions to travellers looking for modern creature comforts, including a colour television discreetly hidden away in each room's antique armoire and a basement sauna and whirlpool. But the floor plan, says Downey, is remarkably

true to the original layout. As for its energy consumption, Downey can't compare the inn with its years as an apartment building. Still, he does say that, given his mandate to preserve the building's architectural details, "Hochelaga is about as tight as an authentic, nineteenth-century home is going to get."

When the architect set out to apply energy-conservation measures to the Hochelaga Inn in Kingston, he had four criteria to meet:

1. The appearance of the windows had to be maintained from both the outside and the inside.
2. Heat loss was to be reduced with weatherstripping and a second pane of glass.
3. The windows were to open the same way as before.
4. The cost, both for the modifications and upkeep had to be reasonable in relation to the expected savings.

The architect had to choose among four possible ways of upgrading the windows:

1. Each original window could be replaced with a thermal sealed fixed window. This method, however, had several disadvantages: it was expensive, the architectural detailing of the window and the frame would be altered, and, since this kind of window can't be opened, the building would probably need air-conditioning.
2. A storm window, probably with a metal frame, could be installed inside the existing window. The disadvantage was that the interior appearance of the windows would be altered and two windows would have to be opened to get fresh air, instead of one.
3. The original glass in each window could be replaced with a sealed thermal pane. This method had several disadvantages. After ten years, the factory seal on thermal panes may be broken, reducing their energy-saving value. Moreover, because thermal panes are thicker than the original glass, the muntins might have to be replaced or planed down. Furthermore, the historic value of the original glass would be lost. And again, thermal panes are expensive.
4. The method the architect finally chose was more modest than the alternatives. It consisted of weatherstripping the existing windows and installing a pane of glass on the inside of each sash against the frame. Not only was this method much less expensive than the other options, but it preserves the original windows, allows them to be opened in the normal way, and scarcely changes their appearance.

■ FOR MORE INFORMATION

The Ministry of Citizenship and Culture in co-operation with the Ministry of Energy, is preparing a publication, *Heritage Energy Conservation Guidelines,* which will be of interest to anyone intending to add energy-conserving measures to a building of architectural or historical importance. It should be available early in 1987. For more information, contact:

The Ministry of Citizenship and Culture
Heritage Branch
Architecture and Heritage Planning
77 Bloor St. W., Second Floor
Toronto, Ontario
M7A 2R9
(416) 965-4961

Local architectural conservation advisory committees exist in many Ontario communities today. Among other things, these committees promote heritage conservation within communities and advise property owners of appropriate heritage conservation and maintenance practices. Most LACAC's can be reached through the municipal clerk's office.

■ FINANCIAL ASSISTANCE

The Ministry of Energy's Municipal Oil Conversion and Energy Conservation Program provides grants and technical assistance to municipalities undertaking fuel conversion or energy conservation programs to existing buildings. The program ends in March 1988. For more information, contact:

The Ontario Ministry of Energy
Municipal Programs
56 Wellesley St. W., 10th Floor
Toronto, Ontario
M7A 2B7
(416) 965-5839

Grants for the conservation and restoration of designated heritage buildings are also available through the Ministry of Citizenship and Culture. Enquiries should be addressed to:

The Ministry of Citizenship and Culture
Heritage Branch
Architectural and Heritage Planning
77 Bloor St. W., Second Floor
Toronto, Ontario
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(416) 965-4961